Date and Time: TBD
Classroom: TBD
Instructor: Nikolaos Voulgarakis
Office: Neill 325
Office Hours: TBD or by appointment
Phone: (509) 335-6163
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Course description: Foundations of continuous time stochastic processes: Kolmogorov forward/backward equations, master equation; general introduction to stochastic calculus and stochastic differential equations. Applications.

Prerequisites: None

Course Outline:
1. Review of Probabilities

PART A
2. Introduction to Stochastic Processes
3. Markov Processes and the Chapman-Kolmogorov equation
4. Differential Chapman-Kolmogorov equation
5. Forward/Backward Kolmogorov equations
6. Jump processes and the master equation
7. Stationary, ergodic and homogeneous processes
8. Five basic stochastic processes: Wiener process, random walk, Poisson process, Ornstein-Uhlenbeck process, telegraph process.
9. Applications

PART B
10. Stochastic Calculus (Ito Integral, Ito Lemma, Ito Isometry, Stratonovich integral)
11. Stochastic Differential Equations (existence and uniqueness, linear and nonlinear SDEs, strong vs. weak solutions)
12. Brief introduction to numerical methods for SDE (Euler and Milstein method, Ito vs. Stratonovich integration) [1]
13. Connections between SDE and Kolmogorov equations
14. Applications

Application include examples from stochastic reaction-diffusion processes, population, growth, and search dynamics, Black-Scholes model.

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[1] Numerical methods may be skipped

Recommended textbooks:
- M. Lefebvre, *Applied Stochastic Processes*
- B. Oksendal, *Stochastic Differential Equations*
- C. W. Gardiner, *Handbook of Stochastic Methods*

Grading:
- Homework: 30%
- Midterm Test: 30% (take home)
- Final Test: 40% (take home)

Academic Integrity is the cornerstone of the university. All assignments are to be done by *you*, not someone else. You are encouraged to work together and to discuss homework assignments by asking questions such as, "How do you do this type of problem again?" or "What is the idea here?" But you should not sit down with someone else's paper in front of you and refer to it to get your work done. Any student who violates the University's standard of conduct related to academic integrity will be referred to the Office of Student Conduct and may fail the assignment and/or the course. You can learn more about academic integrity at http://www.academicintegrity.wsu.edu/

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